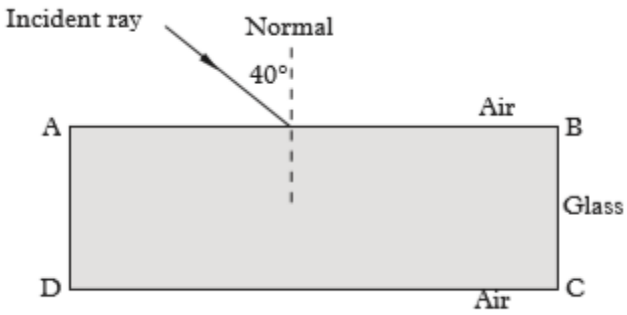
S 5 PHYSICS EXERCISES FOR JULY

1. What is the maximum magnification that is possible with a lens having a focal length of 10 cm, and what is the magnification of this lens when the eye is relaxed?

2. . An object located 32.0 cm in front of a lens forms an image on a screen 8.00 cm behind the lens. (a) Find the focal length of the lens.

(b) Determine the magnification.

(c) Is the lens converging or diverging? 3. a Copy and complete the ray diagram to show the path of light through and out of the glass block of refractive index 1.50.



b) Calculate the angle of refraction in the glass block

c) What will be the angle if refraction in the glass block if the angle of incidence equal to the critical angle.

4. An object is placed 25 cm from a convex lens whose focal length is 10 cm. find the position and the nature of the image.

5. a. Define the term total internal reflection and give two conditions for the total internal reflection to occur.

b. Mention at least three illustrations of total internal reflection

c. On what principle optical fiber does works?
d. Explain why diamonds are cut with their sides flat and others slanting.

6. A 50 mm tall object is placed 12 cm from a converging lens of focal length 20 cm. What are the nature, size, and location of the image?

7. An object 6 cm high is held 4 cm from a diverging meniscus lens of focal length 24 cm. What are the nature and location of the image?

8.(a) Define critical angle.

(b) Write down the relationship between the critical angle and the refractive index of a medium.

9.State the two conditions under which total internal reflection occurs.

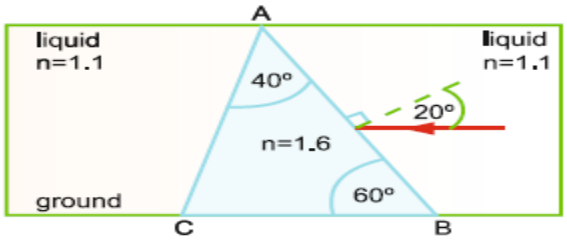
10..Calculate the value of critical angle for a liquid-air interface, if the refractive index of the liquid is 1.40.

11. What is the magnification of a lens if the focal length is 40 cm and the object distance is 65 cm?

12.Calculate the refractive index of diamond, if the critical angle for the diamond is 24°.

13. One convex lens and one concave lens are placed in contact with each other. If the ratio of their power is $\frac{2}{3}$ and the focal length of the combination is $30cm$. What are the values of individual focal lengths

14. . A triangular glass prism (n = 1.6) is immersed in a liquid (n = 1.1) as shown in Fig. below A thin ray of light is incident as shown on face AB making an angle of 20° with the normal



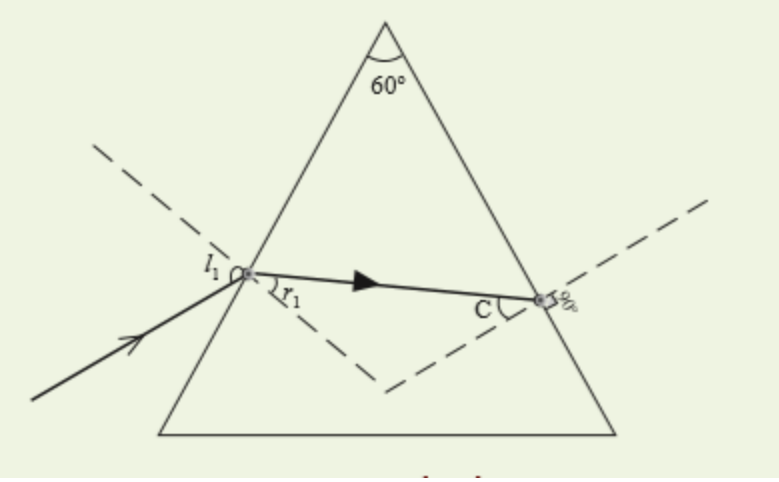
a. Which property of light used above.

b. Calculate the angle that the ray emerging from AC makes with the ground

c. What is the condition for minimum deviation to occur?

d. Determine the critical angle of the prism

10. A ray of light incident from air to a prism of refracting angle 60° grazes the boundary on the second face of the prism. Find the angle of incidence of the ray on the first fa ce. (Take ng = 1.52).



15. Assume the compound microscope has an objective lens of focal length 4.0cm and eyepiece of focal length of 10.0cm. The two lenses are separated by 16.0cm. An object 6.0mm long is placed on the platform of the microscope at 6.0cm from the objective lens. If the microscope is in normal adjustment, calculate the following:

(i) The position of the first image

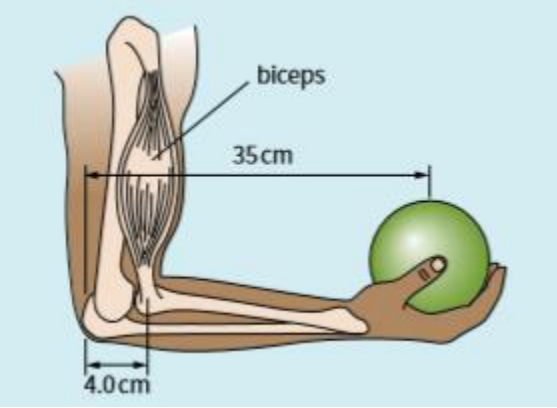
(ii)The magnification of the first image

(iii)The position of the second image

(iv)The length of the second image

(v)The magnifying power in normal adjustment

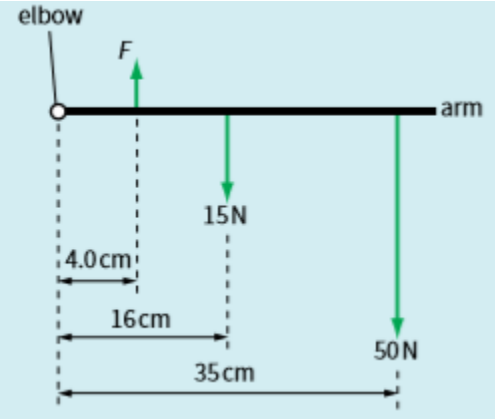
16. The figure below shows the internal structure of a human arm holding an object. The biceps are muscles attached to one of the bones of the forearm. These muscles provide an upward force



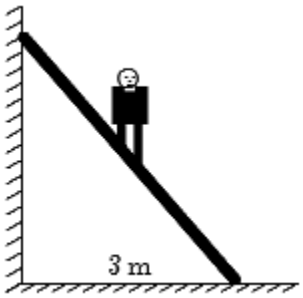
If An object of weight 50 N is held in the hand with the forearm at right angles to the upper arm. Use the principle of moments to determine the muscular force F provided by the biceps, given the following data: weight of forearm = 15 N distance of biceps from elbow = 4.0 cm distance

of centre of gravity of forearm from elbow = 16 cm distance of object in the hand from elbow = 35 cm

Hint: There is a lot of information in this question. It is best to draw a simplified diagram of the forearm that shows all the forces and the relevant distances (Figure 4.21). All distances must be from the pivot, which in this case is the elbow.



17. An 800-N man stands halfway up a 5.0-m long ladder of negligible weight. The base of the ladder is 3.0m from the wall as shown. Assuming that the wall-ladder contact is frictionless. Determine the magniyute of the force the waall pushes against the ladder with(Reaction from the wall)

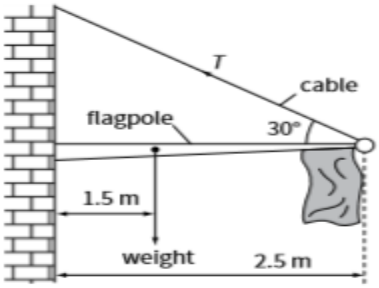


18. a . Explain what is meant by the centre of gravity of an object.

b A flagpole of mass 25 kg is held in a horizontal position by a cable as shown in Figure 4.33. The centre of gravity of the flagpole is at a distance of 1.5 m from the fixed end.

i. Write an equation to represent taking moments about the left -hand end of the flagpole. Use your equation to find the tension T in the cable.

ii Determine the vertical component of the force at the left -hand end of the flagpole.

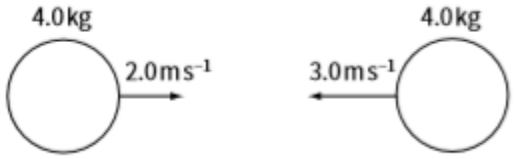


19. a .Define linear momentum.

b. Determine the base units of linear momentum in the SI system.

c. A car of mass 900 kg starting from rest has a constant acceleration of 3.5 m s^{-2}. Calculate its momentum after it has travelled a distance of 40 m.

d.Figure 6.22 shows two identical objects about to make a head-on collision. The objects stick together during the collision. Determine the final speed of the objects. State the direction in which they move.

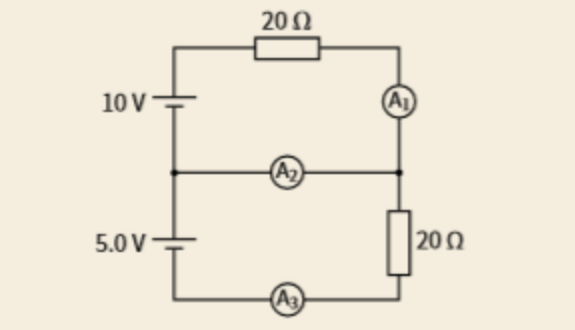


20 a . Give and explain the applications of collision

b**.**. An air track car with a mass of 0.85 kg and velocity of 3.4 m/s to the right collides elastically with a 0.95 kg car moving to the left with a velocity of 4.9 m/s. If the collision is elastic, what is the speed and direction of each ball after the collision?

21. Calculate the mean drift velocity of the electrons in a copper wire of cross-sectional area 5.0 × 10^{-6} m^2 carrying a current of 1.0 A. The electron number density for copper is 8.5 × 10^{28} m^{-3}.

22 Apply Kirchhoff's laws to the circuit shown in Figure 10.15 to determine the current that will be shown by the ammeters A1, A2 and A3.



22. Discuss and describe all forms of renewable energy and in each give advantages and disadvantages of each.

23. A projectile is thrown horizontally with a speed of 300m/s from the top of a building 78.4m high. a) Compute the range of the projectile. b) What is the time taken to reach the ground?

24. A machine gun throws a projectile with a speed of 740m/s Find the range, the maximum height reached by the projectile and the time taken to reach the ground, when it is projected through an angle of 45°.

25. a. Briefly describe how a lightening conductor can safeguard a tall building from being struck by lightening.

b. Find the force between two point charges +4μC and -3μC placed at a distance of 12dm apart in free space.

26. a. Calculate the force of gravity between two bowling balls each having a mass of 8.0kg, when they are 0.50m apart.

b. At the surface of a certain planet, the gravitational acceleration g has a magnitude of 2.0m/s2. A 4.0kg brass ball is transported to this planet. Give: a) The mass of the brass ball on the earth and on the planet; and b) The weight of the brass ball on the earth and on the planet.

27. A gas has a volume of 0.02 m3 at a pressure of 2 x 105 Pa and a temperature of 27o C. It is heated at constant pressure until its volume increases to 0.03 m3. Calculate the:

(i) External work done.

(ii) New temperature of the gas.

(iii) Increase in internal energy of the gas if its mass is 16g, its molar heat capacity at constant volume is 0.8Jmol-1K-1 and the molar mass is 32g.

28. a. Explain why the cooling compartment of a refrigerator is always on top

. The refrigerator cools substances by evaporation of a volatile liquid.

b. Explain how evaporation causes cooling.

(c) State the reason why water is used in the cooling system of a car engine.

29. Venus is at average distance of 1.08 x 10^8 km from a sun. Estimate the length of the Venusian year using the fact that the earth is 1.49x10^8 km.

30 The mass of an electron or positron is 9.11×10^{-31} kg. The speed of light is 3.0×10^8 m/s.

a. Show that the rest energy of an electron is 8.2×10^{-14}J.

b. Use the answer to question 1, to show that the rest energy of an electron is 0.51 MeV.

c. Write down the rest energy of a positron (antielectron).

d. An electron and a positron meet and annihilate one another. By how much does the rest energy decrease in total? Express the answer in MeV. 5. The annihilation of an electron and a positron at rest produces a pair of identical gamma ray photons travelling in opposite directions. Write down (in MeV) the energy you expect each photon to have.

31. A baby in a 'baby bouncer' is a real-life example of a mass-on-spring oscillator. The baby sits in a sling suspended from a stout rubber cord, and can bounce himself up and down if his feet are just in contact with the ground. Suppose a baby of mass 5.0 kg is suspended from a cord with spring constant 500 N m–1. Assume g = 10 N kg–1.

(a) Calculate the initial (equilibrium) extension of the cord.

(b) What is the value of angular velocity?

(c) The baby is pulled down a further distance, 0.10 m, and released. How long after his release does he pass through equilibrium position?

(d) What is the maximum speed of the baby?

32. An object oscillates with simple harmonic motion along the x axis. Its position varies with time according to the equation x = (4.0 m) Cos (∏t+∏/4) where t is in seconds and the angles in the parentheses are in radians.

(a) Determine the amplitude, frequency, and period of the motion.

(b) Calculate the velocity and acceleration of the object at any time t.

(c) Using the results of part (b), determine the position, velocity, and acceleration of the object at t = 1.0 s.

(d) Determine the maximum speed and maximum acceleration of the object.

(e) Find the displacement of the object between t = 0 s and t = 1.0s.

33. A. Differentiate transverse wave from longitudinal waves.

34.

a) How do you call the distance represented by arrow z?

b) What letter is labelling the wave's trough?

c) What letter is labelling a wave's crest?

d) The number of waves that pass the poster per second is called the …….. of the waves.

e) If the knot (w) travels 2 meters in 1 second, we say that it has …… ….. of 2 m/s.

f) If the wavelengths were shortened, would the frequency be higher or lower?

g) The greatest distance the knot (w) travels from its resting position is called…….. of the wave.

h) What kind of wave are these in the rope?